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Outdoor Wood Finishes

Varnish is pretty, but paint's tougher

by William C. Feist

If properly protected and sheltered from the elements, wood is a remarkably durable material. Even when buried or submerged in water, it can retain its strength for many years. Unfinished wood exposed to the harsh effects of wind, rain and sun, however, coupled with the decaying action of fungi, may become useless within a year or two.

Water is the worst enemy of wood left outdoors. Rain and heavy dew are readily absorbed by unprotected wood. At first this causes differential swelling between earlywood and latewood, raising the grain so the wood looks—and is—weathered. Eventually moisture cycling creates enough stress to warp boards, straining fastenings and often cracking the wood. Sunlight, too, takes a toll. Ultraviolet radiation rapidly breaks down the lignin that binds wood fiber together. Sunlight initially affects the top layers of wood, bleaching some species while darkening others. Continued exposure causes slow disintegration.

Sometimes people prefer the look of weathered wood. Usually, though, we want to protect wood that must be left outside, by applying some sort of finish. There are basically two kinds of finish: those that form a film on the wood surface—paints and varnishes—and those that penetrate the wood—water-repellent preservatives and pigmented or semi-transparent stains.

Of all the finishes, paint provides the most protection. A properly applied paint film limits checking and warping by keeping water out, and its pigments (depending on amount and type) filter ultraviolet rays. Paints are classified by their solvents as either solvent-borne or waterborne. Solvent-borne paints are suspensions of inorganic pigments in an appropriate vehicle that binds the pigment particles to each other and to the wood surface. For practical purposes, alkyd-resin paints are the same as oil paints, since alkyds are synthetic substitutes for natural linseed and tung oils. Waterborne, or latex, paints are suspensions of inorganic pigments and latex resins in water. These resins can be any of a number of plastic compounds, including polyvinyl acetate, polyvinyl chloride and acrylic, the same basic resins used to make white glue, garbage bags and Plexiglas, respectively.

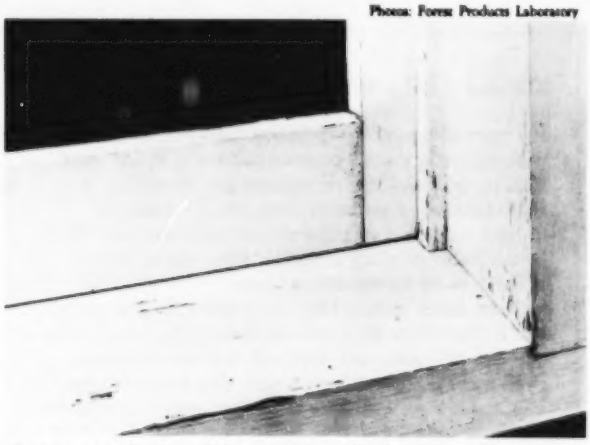
Although the impervious film of an oil paint provides the best shield from liquid and vaporous water, it's not necessarily the most durable. No matter how well sealed, wood still moves with seasonal humidity, stressing and eventually cracking the paint. Latex paints, particularly the acrylics, remain more flexible, and even though they pass more water vapor, they hold up better by stretching and shrinking with the wood. Our test fences at the Forest Products Lab show that the all-acrylic latexes, applied in two coats over an oil-based or stain-blocking latex primer, last longest.

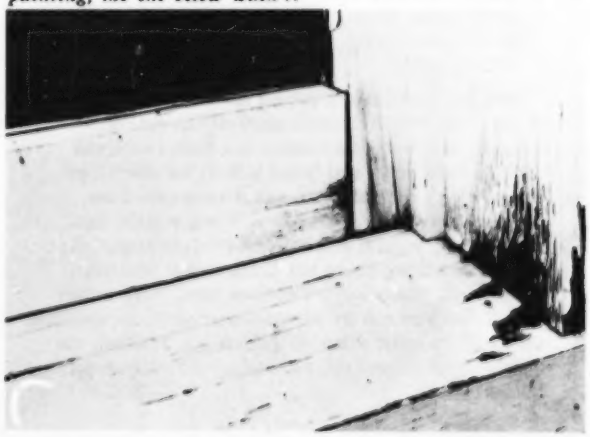
Most paint complaints involve cheaper products, leading me to believe that high-priced paints are probably worth the extra money. Better paints usually contain 50% solids by weight. Paints with less than 50% solids may be cheaper by the gallon, but they will cost more per pound of solids, and you'll have to apply more or heavier coats to get equal coverage. At FPL we evaluate paints by generic type. *Consumer's Report* (256 Washington St., Mount Vernon, N.Y. 10550), however, does extensive weather-testing by brand.

A coat of a water-repellent preservative before priming and painting greatly prolongs the life of the paint. Film finishes usually fail first at joints, so give these points, particularly any exposed end grain, an extra coat of water-repellent.

Whether oil or latex, two coats of paint should follow the primer. Our research shows that a single coat over a primer may last four or five years, but two coats can last up to ten. The optimum thickness of primer and paint is 0.004 in. to 0.006 in., about the same as newsprint. Thicker films are liable to fail prematurely, creating a rough, cracked surface

Photos: Forest Products Laboratory





Paint is wood's best defense against the elements, and a water-repellent is paint's strongest ally. Five years ago, the window above was treated with a water-repellent preservative before painting; the one below wasn't.

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that can be made smooth again only by a laborious stripping back to bare wood.

Oil paints may adhere better to weathered paint surfaces than latex paints do. If you're in doubt, try this test: Clean and paint an inconspicuous spot with latex and let it dry overnight. Press a bandaid onto the paint, then briskly snap it off. If the bandage lifts a chip of paint, you'll have to clean the surface and try again, or switch to an oil-based paint. Never paint over mildew, for it will just grow through. Instead, clean off the mildew with a solution of ⅓ cup liquid detergent mixed with 1 quart household bleach and 3 quarts warm water. Never mix bleach with detergents containing ammonia; the combination releases a lethal gas.

If you want to show off the lavish joinery of your picnic table through clear varnish, be prepared to refinish often. Even the toughest varnishes have only a fraction of the durability of paints, often breaking down in a year or less. This is because ultraviolet light penetrates the film and attacks the wood, whose breakdown cracks the varnish, which then sloughs off. Hardwoods, with their lower lignin content, may be a better choice for varnish, but you'll still need to maintain the finish regularly. Some varnishes contain ultraviolet-inhibitors, which protect the film itself but not the wood underneath.

Marine spar varnishes, made from tung and linseed oils with driers added, have been the traditional clear outdoor finishes. Phenolic-based varnishes and polyurethanes, essentially liquids that cure into plastic films, are more resistant to moisture and abrasion than oil varnishes are, but all types weather about equally. Two-part polyurethanes are tougher and perhaps more ultraviolet-resistant, but they are expensive and difficult to use, and have a short pot-life.

Varnish built up in many thin coats instead of two or three thick ones will usually perform best. As many as six coats may be needed, with a sanding and a fresh coat once a year. To prolong a varnish finish, shade it from the sun. If you hide varnished outdoor furniture under trees, however, rinse it occasionally to remove bird and leaf excretions, which can also attack the film.

The best compromise between opaque, grain-obscuring paints and short-lived varnishes may be clear water-repellent preservatives or colored semi-transparent stains. These products protect by partially sealing out moisture and light, and by penetrating the wood, leaving it slightly exposed and working in concert with the elements to weather the surface without degradation. These materials are easy to apply and durable, and are particularly effective on roughsawn wood.

Water-repellent preservatives are mixtures of petroleum solvents, paraffin, resins or drying oils, and preservatives (mildewcides) such as pentachlorophenol and copper naphthenate. They don't form a film and therefore don't protect the wood against water vapor or ultraviolet light. They do, however, exclude liquid water, thus inhibiting the growth of mildew and other fungi, making them suitable for any outdoor woodwork that will benefit from some weathering. Semi-transparent stains are water-repellents plus pigments that impart some ultraviolet-shielding. These stains are made in many colors, and since no film is formed, they won't crack or blister. Don't confuse these stains with opaque stains—specially formulated thin paints best used when you want the wood's texture but not its grain to show. An important caution: Pentachlorophenol is toxic and a skin irritant. Stains and water-repellents containing it shouldn't be used on outdoor furniture, playground equipment, or decks around swimming pools. Also, penta can kill plants. Newer waterborne water-repellent preservatives may be less hazardous to use.

Stains and water-repellents are more versatile than paints or varnishes. They can be applied over hardwood or softwood, rough lumber, smooth boards or plywood. Water-repellent preservatives are best dipped, but a liberal brush coat to the point of refusal is fine. The treatment should last one or two years, and should be repeated when water soaks in instead of beading and running off, or when the wood looks dry and gray. To refinish, simply clean the surface with a bristle brush and then brush on more.

Depending on the color and the amount of grain you want to show through, one coat of stain might do. But as with paints, two coats are better. Brush on the second coat before the first has dried. An hour or so later, wipe off any excess to keep glossy spots from forming. Two coats of stain may last ten years, and a recoating then should last even longer because the stain will soak into surface checks that opened up as the wood weathered. □

Add oil, color, and stir

If I were shopping for an outdoor wood finish, I'd probably pick a semi-transparent stain. I would want it to be oil-based, for penetration and durability. It should contain a water-repellent. And I'd want it to have some sort of preservative, particularly if I lived in the South or along a humid coast, where mildew is likely to be a constant problem.

Paint stores usually have these stains in great variety, but if they're too expensive for you or the wrong color, you can mix your own from this formula we developed at FPL about 25 years ago. The amounts listed will make 5 gallons. You can scale down the recipe for a smaller amount.

Boiled linseed oil	3 gal.
40% pentachlorophenol solution	¼ gal.
Paraffin (melted)	1 lb.
Burnt sienna (brown iron-oxide) tinting color	1 pt.
Raw umber tinting color	1 pt.
Mineral spirits	1 gal.

Melt the paraffin in a double boiler, taking care not to get it too hot. Add the linseed-oil/mineral-spirits solution, and when the mixture has cooled to about 70°, add the penta and blend it with the other ingredients. Don't breathe the fumes from any of these materials, particularly the penta. Work outside, and wear gloves, goggles and an organic-vapor respirator.

One nice thing about this finish is that you can modify it in many ways. The tints listed make cedar-brown, but you can try any combination of the universal tints sold by paint stores. If mildew is a problem, use half as much linseed oil, making up the volume with mineral spirits. —*W.C.F.*

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